CLAIMS

We claim

1. A method of nickel salicidation comprising:

forming a processed substrate including partially fabricated integrated circuit components and a silicon substrate;

incorporating nitrogen into said processed substrate;

depositing nickel onto said processed substrate; and

annealing said processed substrate so as to form nickel mono-silicide.

2. The method as claimed in claim 1, wherein said partially fabricated integrated circuit components include gate and source/drain structures.

3. The method as claimed in claim 2, wherein said forming a processed substrate comprises:

forming dielectric regions in said silicon substrate that electrically isolate neighboring integrated circuit devices;

at least one of n-type doping and p-type doping a portion of said silicon substrate to form said source/drain structures;

depositing a gate dielectric material and a polycrystalline silicon gate material onto said silicon substrate and selectively etching; and

depositing a dielectric material onto said silicon substrate and selectively etching to form dielectric spacers.

4. The method as claimed in claim 1, wherein said incorporating nitrogen into said processed substrate comprises doping said processed substrate with nitrogen.

5. The method as claimed in claim 1, wherein said incorporating nitrogen into said processed substrate comprises implanting nitrogen ions into said processed substrate.

6. The method as claimed in claim 5, wherein said implanting nitrogen ions comprises a blanket N_2^+ ion implantation of said processed substrate.

7. The method as claimed in claim 6, wherein said blanket N_2^+ ion implantation comprises implanting ions with a dosage between $2*10^{14}/cm^2$ and $2*10^{16}/cm^2$, and an ion energy between 15 keV and 50 keV.

8. The method as claimed in claim 1, further comprising annealing said processed substrate prior to said depositing nickel.

9. The method as claimed in claim 8, wherein said annealing said processed substrate prior to said depositing nickel comprises rapid thermal processing at a temperature between 800°C and 1000°C, for a duration of between 30 seconds and 60 seconds.

10. The method as claimed in claim 1, wherein said depositing nickel comprises applying a solution including hydrogen fluoride to said processed substrate and blanket sputter depositing between 100Å and 300Å of said nickel onto said processed substrate.

11. The method as claimed in claim 1, wherein said annealing said processed substrate so as to form nickel mono-silicide comprises one-step rapid thermal processing at a temperature between 400°C and 800°C.

12. The method as claimed in claim 1, further comprising:

removing unreacted nickel after said annealing said processed substrate so as to form nickel mono-silicide; and

performing a series of integrated circuit fabrication procedures after said removing unreacted nickel, including:

depositing a dielectric material onto said processed substrate and selectively etching;

planarizing said processed substrate; and

depositing metal onto said processed substrate and selectively etching to form metal lines.

13. The method as claimed in claim 12, wherein said removing unreacted nickel comprises etching said unreacted nickel using a solution containing at least one of sulfuric acid, hydrogen peroxide, nitric acid, hydrochloric acid, water, a solution of sulfuric acid, hydrogen peroxide and water, a solution of nitric acid and hydrochloric acid, and a solution of hydrochloric acid, hydrogen peroxide and water.

14. The method as claimed in claim 12, wherein said annealing said processed substrate so as to form nickel mono-silicide and said removing unreacted nickel comprise a process to form a gate electrode including nickel mono-silicide and polycrystalline silicon that is electrically isolated from a source/drain contact including nickel mono-silicide and single crystal silicon.

15. The method as claimed in claim 1, wherein at least one of said incorporating nitrogen and said depositing nickel is applied to a region smaller than the entire top surface of the processed substrate.

16. An integrated circuit device comprising:

a silicon substrate;

a single crystal silicon integrated circuit component structure;

a polycrystalline silicon integrated circuit component structure;

nitrogen incorporated into said single crystal silicon integrated circuit component structure and said polycrystalline silicon integrated circuit component structure; and

nickel mono-silicide on top of said single crystal silicon integrated circuit component structure and said polycrystalline silicon integrated circuit component structure.

17. The apparatus as claimed in claim 16, wherein said single crystal silicon integrated circuit component structure comprises a source/drain structure and said polycrystalline silicon integrated circuit component structure comprises a gate structure.

18. The apparatus as claimed in claim 17, wherein said nitrogen is incorporated into said gate structure and said source/drain structure by doping said gate structure and said source/drain structure with nitrogen.

19. The apparatus as claimed in claim 17, wherein said nitrogen is incorporated into said gate structure and said source/drain structure by implanting nitrogen ions.

20. The apparatus as claimed in claim 19, wherein said implanting nitrogen ions comprises a blanket N_2^+ implantation of said silicon substrate.

21. The apparatus as claimed in claim 20, wherein said blanket N_2^+ implantation comprises implanting ions with a dosage between $2*10^{14}/cm^2$ and $2*10^{16}/cm^2$, and an ion energy between 15 keV and 50 keV.

22. The apparatus as claimed in claim 17, wherein defects in said source/drain structure and said gate structure are removed by rapid thermal processing said silicon substrate at a temperature between 800°C and 1000°C, for a duration of between 30 seconds and 60 seconds.

23. The apparatus as claimed in claim 16, wherein said nickel mono-silicide comprises a 220-660Å thin-film formed by:

applying a solution including hydrogen fluoride to said silicon substrate;

sputter depositing nickel onto said integrated circuit component structures;

annealing said silicon substrate by one step rapid thermal processing at a temperature between 400°C and 800°C; and

removing unreacted nickel metal.

24. The apparatus as claimed in claim 17, wherein said nickel mono-silicide on top of said gate structure comprises a low resistivity gate electrode that is electrically isolated from said nickel mono-silicide on top of said source/drain structure that comprises a low resistivity source/drain contact.